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## HYDROSALPINX—ITS VISUALIZATION BY HYSTEROSALPINGOGRAPHY\*

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SINCE 1926 considerable experience in hysterosalpingography has been gained by men in many parts of the world. Some comment has been made declaring the procedure dangerous, strangely enough, by those not familiar with it, while those who have had extensive experience in the matter all agree not only as to its innocuousness, but also that it has given us another excellent method for increasing our diagnostic acumen. The literature is sparse on the subject of untoward effects following the injection of the uterus and tubes with iodized oil for the purpose of visualizing the cavities of these organs with the roentgen ray. It is obvious that the men who have had much experience with hysterosalpingography know its limitations and contraindications and they must of necessity be on their guard to avoid any dangers that might result from this manipulation. It is also obvious that strict aseptic and antiseptic precautions should attend the injection; 200 millimeters of mercury should be the upper limit of the pressure used and the injection should not be made in the face of acute active infection of the parts involved. Otherwise the actual maneuver requires about the same intelligence as would the sounding of the uterine cavity. By using these precautions the method becomes safe, sane and valuable, and there should be no need for any hullabaloo concerning its dangers. The men who have pioneered in this work should be given due credit for their efforts. The value of hysterosalpingography is well known and is as welcome as that of visualizing the bronchial tree or the urinary tract, and, mind you, the method is as safe and as firmly established as an aid to gynecologic study as the above diagnostic methods are in their particular fields.

### HYSTEROSALPINGOGRAPHY—AN AID TO GYNECOLOGIC DIAGNOSIS

What has hysterosalpingography done as an aid to gynecologic diagnosis? It has done all that could be expected of it; it has markedly increased the number of correct gynecologic diagnoses; it has furnished much new academic knowledge on this subject; it has markedly increased the interest in finished and complete diagnosis; and, above

all, it has established pathognomonic signs in one gynecologic condition about which little has been known and in which a correct diagnosis is not often made. This condition is a type of hydrosalpinx which is rather common, not often diagnosed clinically and not often suspected.

### TYPES OF HYDROSALPINGES

Froiriep in 1834 classified hydrosalpinges into two groups—the one, hydrops tubae fallopiae occlusae, in which both ends of the tube were closed, and the other, hydrops tubae fallopiae apertae, in which the distal end of the tube was closed and the cornual end open and permeable. It is concerning this last type that this paper is being written. This group comprises about 80 per cent of all small hydrosalpinges, is usually bilateral, and is much more common than one has believed.

There is another type of hydrosalpinx, hydrops tubae profluens, a condition described in medical prints as a hydrosalpinx with the uterine end of the tube open and permeable and the sac full of serous fluid which accumulates rather rapidly at times and empties into the uterus when the tube becomes full. This was considered a rare condition and only a few cases were described. The main complaint of the patient was that she lost a great quantity of clear serous fluid from the vagina more or less periodically. Curtis says that hydrops tubae profluens is a clinical entity, but I am skeptical concerning this condition. I am not satisfied that the cases quoted in the literature were proven and I have my doubts that the fluid in a hydrosalpinx accumulates in the manner supposed by these authors. I believe that all large hydrosalpinges occur in tubes that are closed at both ends, the closure at the cornual end being an actual occlusion or a closure caused by kinking or twisting of the tube. I cannot see how the fluid in a hydrosalpinx sac can increase, once the acuteness of the infection has subsided. There may be some actual increase of the fluid due to the secretion from the glands in the mucosa lining the tube, but the amount of this secretion must be almost negligible. The only condition which I can conceive simulating hydrops tubae profluens would be that in which the fimbriated end of an otherwise healthy fallopian tube was adherent to a large ovarian cyst which would rupture into that area within the circumference of the fimbriated end of the adhered fallopian tube. In such a case, one could see how there might be an occasional evacuation of a large amount of clear fluid through the tube and uterus into the vagina. While presumably this condition would be extremely rare, it could exist. At any

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Bibliography will be given in the reprints.

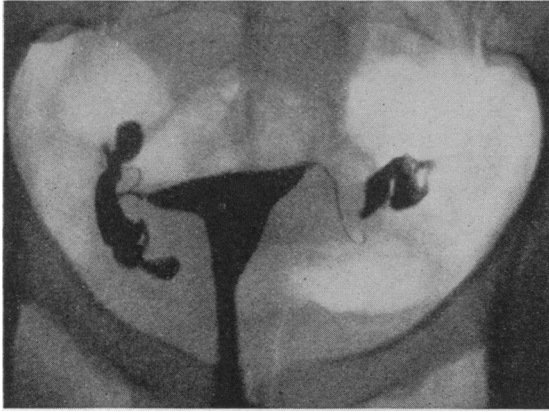


Fig. 1A.—Hysterosalpingogram of normal uterus and tubes. Normal dilatation of the ampullar portion of the tubes with evidence of spilling of the iodized oil at the fimbriated ends.



Fig. 1B.—Twenty-four-hour film after the injection of iodized oil into normal uterus and tubes. The oil is scattered in the pelvis.

rate, the use of iodized oil and the roentgen ray would surely clear up the diagnosis in all supposed cases of hydros tubae profluens.

#### ETIOLOGY OF HYDROSALPINX

The etiology of hydrosalpinx is that of salpingitis and perisalpingitis, and beyond doubt the vast majority of cases are due to single mild gonorrheal infections. Many believe hydrosalpinx to be a progression of pyosalpinx. Since the pathologic findings in small simple hydrosalpinx, large hydrosalpinx and pyosalpinx are so different, just so must there be a difference in the severity of the infection, its conduct with regard to the tissues involved and in the patient's reaction to this infection. Why does one patient have a small simple hydrosalpinx with the uterine end of the tube open and permeable while another has a huge hydrosalpinx with both ends of the tube closed? Curtis, who has had an enormous clinical experience combined with laboratory study of gonorrheal tubes, says that a single introduction of infection usually eventuated in relatively mild pathologic changes. Severely diseased tubes rarely result from a single exposure, even though the invading organism is virulent.

Excepting the difference in the type of pathologic lesions formed by the gonococcus, the tubercle bacillus and the pyogenic streptococcus, I believe that the difference in the pathologic end condition is the difference in the severity of the infection. Consider the gonococcus infection. I believe that all of the small hydrosalpinges of which I am speaking are due to mild infections with attenuated gonococci and that the larger

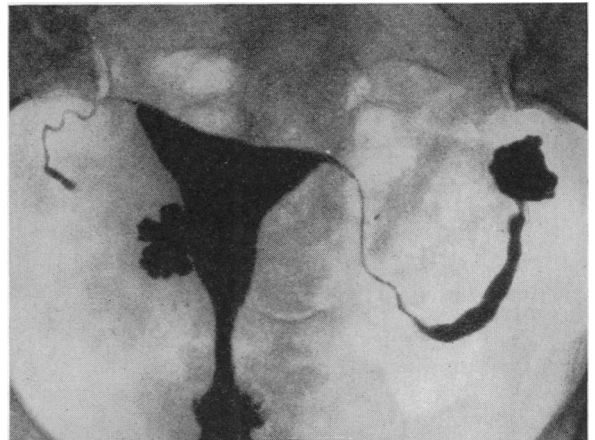
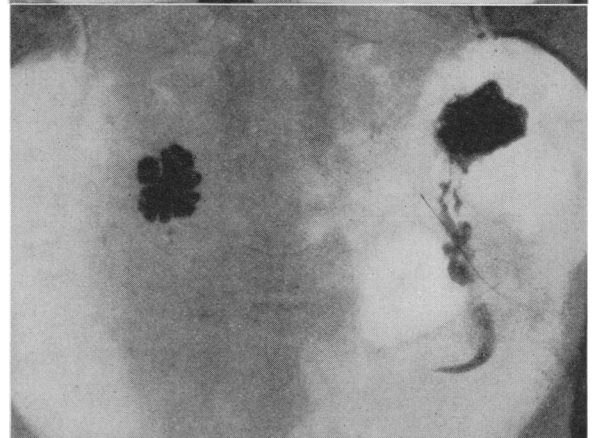


Fig. 2A.—Hysterosalpingogram of bilateral hydrosalpinges. Note the iodized oil contained in sacs at the ends of the tubes. Rosette formation in the distal end of right tube outlining the tucked-in fimbria of the tube. Note the beading in the left tube due to muscular peristalsis.

Fig. 2B.—Film of Figure 2A, taken ten minutes after the removal of the canula. Note that most of the oil in the uterus and tubes is already evacuated, that a portion of the oil in the left tube seems to be gravitating downward and that the oil is remaining in the hydrosalpingeal sacs.

Fig. 2C.—Twenty-four-hour film of 2A. Two sacs of iodized oil hanging in the pelvis. A pathognomonic sign of hydrosalpinx.



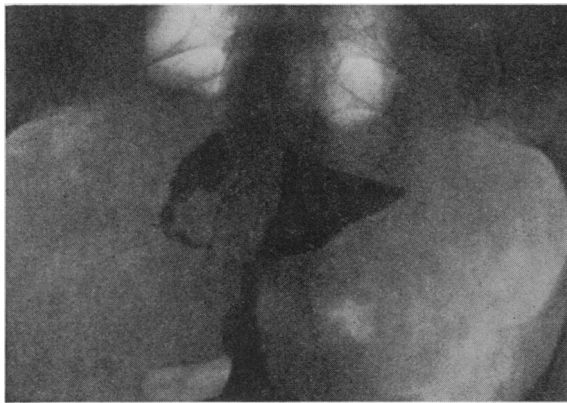


Fig. 3A.—In this case the left tube had been removed for ectopic pregnancy. Note the wide dilatation of the ampullar end of the right tube and the lack of evidence of spilling through the distal end.



Fig. 3B.—Twenty-four-hour film of 3A, showing sac of iodized oil.

hydrosalpinges, the pyosalpinges, and the tubo-ovarian abscesses are due to a more virulent type of the same germ, or to repeated infections as suggested by Curtis.

#### A COMPOSITE HISTORY—FROM SEVENTEEN CASE RECORDS

A composite history of the seventeen patients whose disease I am discussing is as follows: The complaints are sterility, dysmenorrhea or dysparunia, and there is often no history of a gonorrheal infection. They usually complain of mild but continuous pelvic distress; indeed many come to the gynecologist only because of their sterility. On examination, smears are negative for gonococci and there is no evidence of an acute infection, but there is usually found a slight thickening and hardening of one or both Bartholin glands, evidence of Skene gland infection, a cervicitis and tenderness in the pelvis on bimanual examination. Occasionally one feels what seems to be a small cystic ovary or a loop of gut, but usually the pelvic examination is unsatisfactory and no large masses or signs of pelvic disease are found. In some cases I have examined these patients under general anesthesia with the

same findings. I mean to suggest that at times the hydrosalpingeal sacs are so soft that they are not recognized. The condition of the Bartholin or Skene glands or the slight tenderness causes one to renew the investigation into the history and this time, with more direct questioning, one can elicit the following history: Shortly after the first intercourse there was noticed painful and frequent micturition, followed by dysparunia, dysmenorrhea, slight but continuous pelvic pain and a vaginal discharge.

This picture is often found in young women, married and sterile. From this history it would appear that the young husband infected his wife with an attenuated gonococcus, having thought himself cured of the disease and having married prematurely. The ensuing infection is a rather mild affair, causing little distress to the woman and almost passing her notice. In this type of case the infection is sufficiently severe to cause an active endosalpingitis and perisalpingitis wherein there is a swelling of the outer layers of the tube and some involvement of the mucosa. The inflammation and swelling of the tube cause a tightening of the peritoneal ring around the distal end of the tube, the fimbria are pulled into the



Fig. 4A.—Film shows uterus deviated to the right and retroverted. The right tube fills to its distal end normally and there is evidence of spilling. The left tube shows a marked dilatation at its distal end with droplet sign (coarse emulsion). The oil appears to be emulsified in the fluid of a hydrosalpinx. A twenty-four-hour film (Figure 4B) is necessary to complete the diagnosis.



Fig. 4B.—Twenty-four-hour film of 4A. Note the iodized oil disseminated in the right side of the pelvis, having leaked out of the end of the right tube. Note, also, the bag of iodized oil hanging in the left pelvis. Diagnosis: Patent right tube, small hydrosalpinx of left tube.

tube by the swelling and sealed in this position and the end of the tube becomes closed. A transudate or an exudate forms and fills the tube with serous fluid. Soon the infection subsides, leaving the tube closed at its distal end, but still patent at its proximal end with the outer third of the tube distended, thin-walled and filled with fluid. A simple hydrosalpinx, averaging four centi-

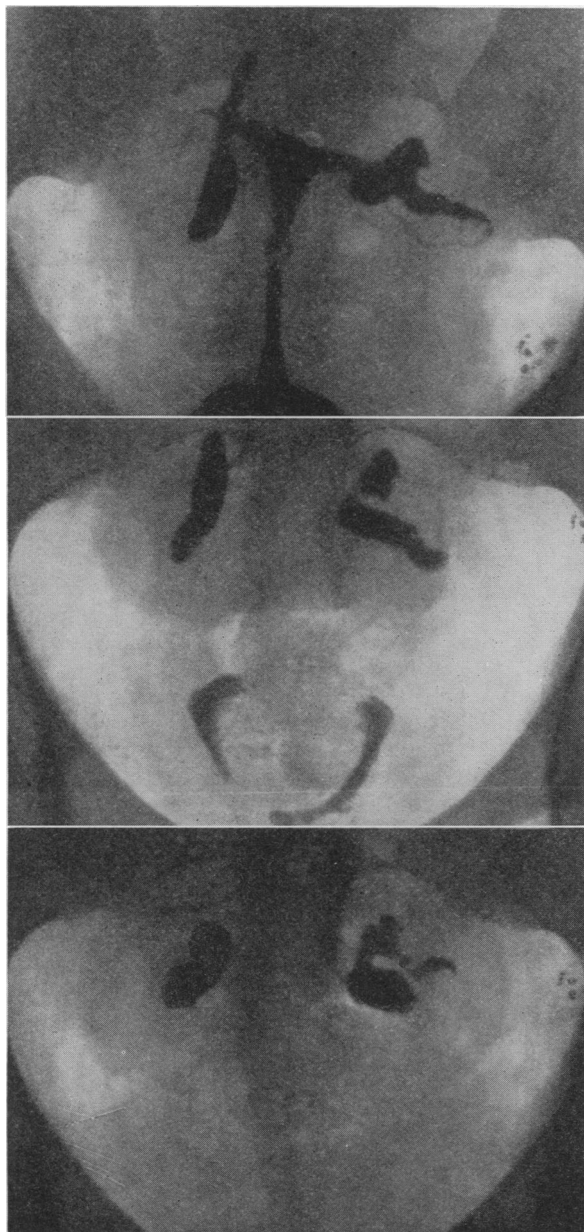


Fig. 5A.—Note marked dilatation of the ampullar portions of both tubes. The iodized oil seems to be retained in the end of each tube. This is strong presumptive evidence of bilateral hydrosalpinx.

Fig. 5B.—Hysterosalpingogram of 5A five minutes after the canula had been removed. Note that there is iodized oil visible in the lower part of the pelvis, probably in the vagina. Note also the two bags of oil hanging in the pelvis—the uterus and the proximal portions of the tubes being free from iodized oil.

Fig. 5C.—Film of 5A, taken one week after the injection of the iodized oil. Note the sacs of iodized oil. Diagnosis: Bilateral hydrosalpinx. The small shadows in the left part of the pelvis, seen in every roentgenogram of the patient, are probably due to phleboliths.

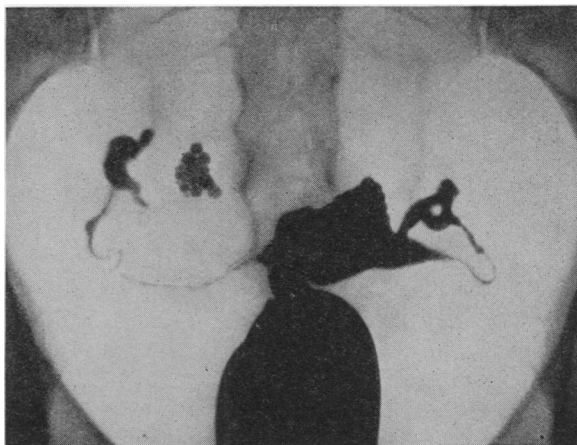


Fig. 6.—This roentgenogram shows well the droplet sign produced by the mixture of oil and fluid in the tube. The twenty-four-hour film showed the oil to be retained in sacs, proof of bilateral hydrosalpinges.

meters in length and two centimeters in breadth, remains, attached to and hanging down behind the broad ligament. The adhesions about this sac are not firm or tough and the sac can usually be peeled from the posterior surface of the broad ligament without rupture. This process seems to involve only the distal third of the tube in mild cases. On the other hand, were this infection virulent or were there reinfections, a more severe pathologic condition would be seen and there would be found a large closed hydrosalpinx, a pyosalpinx, a tubo-ovarian abscess or a pelvic abscess.

#### PATHOLOGIC FINDINGS

The pathologic findings are usually as follows: The distal end of the tube is closed, the fimbria being tucked inside and sealed in this position. The distal third of the tube is dilated and converted into a thin-walled sac containing a serous fluid. The thinning of the wall of the sac is usually in direct proportion to the amount of dilatation. The mucosa is not especially involved

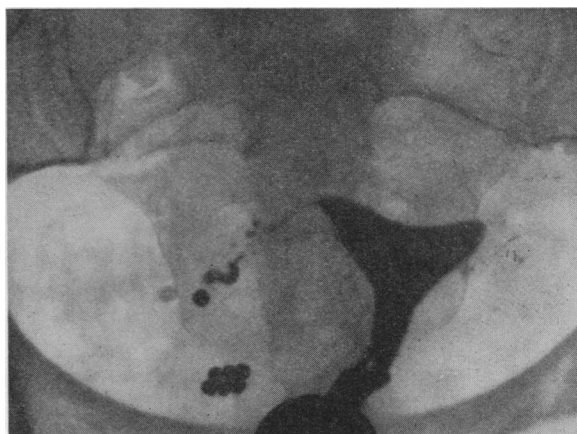


Fig. 7.—Note six drops of iodized oil low in the pelvis. This is the droplet sign, an emulsion of oil and other fluid. In this case, this sign was caused by the oil dropping into free fluid in the culdesac, for the twenty-four-hour film showed the oil scattered freely in the pelvis and not contained in a sac. This proves that the droplet sign, though suggestive of hydrosalpinx is not pathognomonic of that condition.



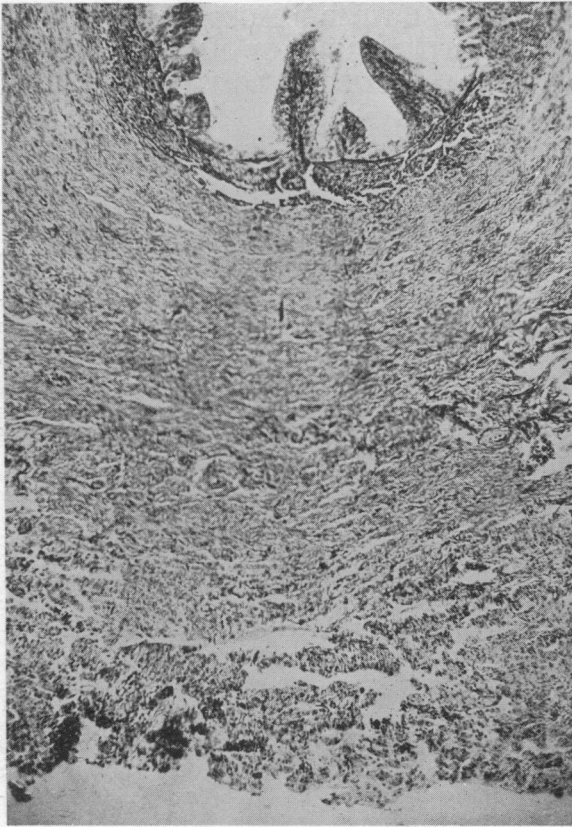


Fig. 8A.—Proximal third of one tube. No changes. Number two and three are from the same tube, and are of same magnification.

except by pressure, and the morphologic characteristics of the tubal epithelium are practically unchanged. The chief pathologic findings are a marked atrophy of the muscular coat, an increase in the elastic fibers and markedly dilated capillaries. Sections of the tube taken proximal to the sac show fairly normal musculature (Figures 8A, 8B, 8C).

#### HYSTEROSALPINGOGRAPHY

The signs of this disease obtained by hysterosalpingography are pathognomonic. The hysterosalpingogram of the normal tube (Figure 1A) shows filling to the distal end, shows the normal amount of dilatation in its distal third and shows evidence of spilling of the iodized oil through its fimbriated extremity. The control film (Figure 1B), taken twenty-four hours later, shows the uterus and tubes absolutely empty of iodized oil while shadows of the oil are seen scattered throughout the pelvis. Experience with hysterosalpingography has taught us that the proximal two-thirds of the tube empties itself by peristaltic muscular waves into the uterine cavity, while iodized oil in the fimbriated region of the tube, probably because of gravity and because of the dilatation of this portion of the tube, drops into the pelvic cavity. This evacuation of the tube usually takes place within thirty minutes or less after the injection of iodized oil into the normal tube, and has been proven many times by series of roentgenograms taken after the canula was

removed. The twenty-four-hour roentgenogram, showing the iodized oil scattered about in the pelvis, is absolute evidence of the patency of at least one tube (Figure 1B).

In the case of hydrosalpinx with the cornual end of the tube open and permeable, the findings are quite different but absolutely characteristic. In the film taken at the time of the injection (Figures 2A, 3A, 4A, 5A), the tube shows a marked dilatation of its distal third from three or four times normal, there is no evidence of spilling and the oil seems to be contained in a well-outlined sac in the end of the tube. The proximal two-thirds of the tube appears to be normal. The twenty-four-hour film (Figures 2C, 3B, 4B, 5C) shows the uterus and the proximal two-thirds of the tube empty and clear of iodized oil. The shadow of the distal end of the tube is the same as it was the day before, and if another film is taken a week or two later the same bag or shadow, unchanged, will be seen. This shadow of the iodized oil in this definite unchanging form is a pathognomonic sign of hydrosalpinx. Since the condition is usually bilateral, one sees in the twenty-four-hour film the shadows of two bags of iodized oil hanging down, one in each side of the pelvis (Figure 2C). The emptying of the tube in a case of hydrosalpinx is different from the emptying of a normal tube. The iodized oil in that portion of the tube which still possesses a good muscular layer is evacuated into the uterus by peristaltic muscular waves (Figures 2A, 2B, 2C), while that portion of the iodized oil which is in the sac remains there because the muscula-

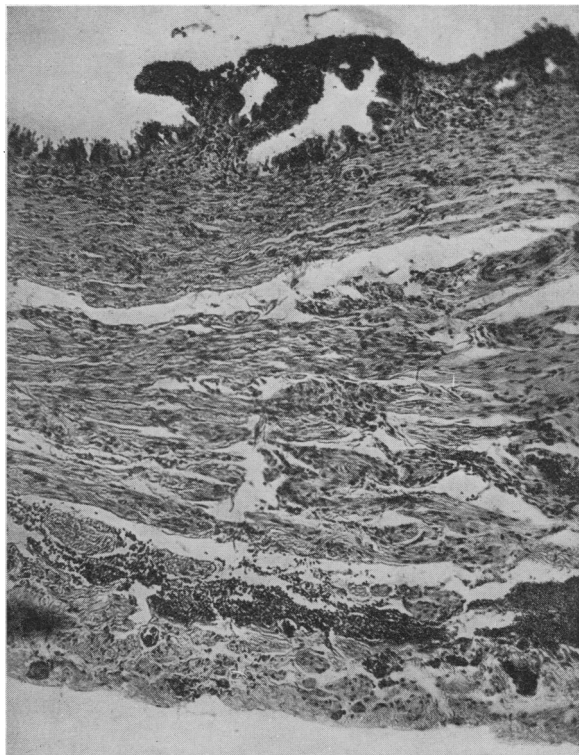


Fig. 8B.—Middle third of hydrosalpinx wall. Slight atrophy of muscular bundle with blunting of mucosal folds.

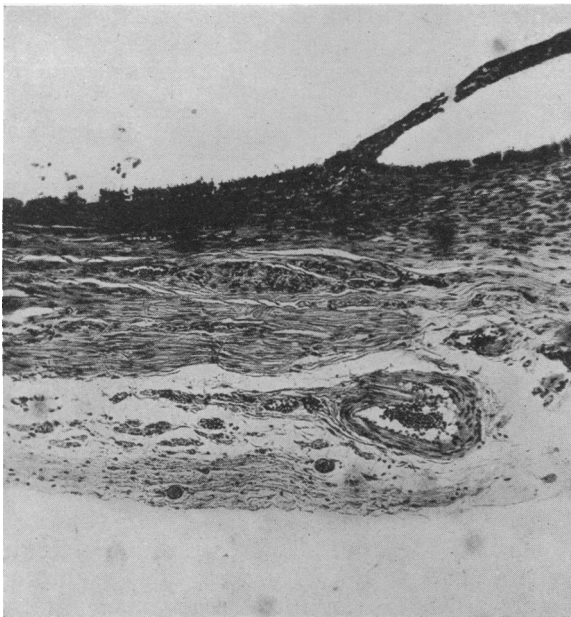


Fig. 8C.—Distal end of hydrosalpinx wall. Shows marked thinning and atrophy of the muscle and obliteration of mucosal folds.

ture in this portion of the tubes is so thinned out that it cannot function (Figure 2C). We know that the emptying of the healthy portion of the tube into the uterus is not due to any siphon mechanism because we have watched this portion of the tube empty itself long after the canula has been removed (Figures 2A, 2B, 2C).

There is still another sign which is characteristic of hydrosalpinx as visualized with iodized oil and the roentgen ray. Often when the oil enters the tube and drops into the sacculated portion containing the serous fluid, it mixes with this fluid as a rather coarse emulsion and the shadow on the film shows many droplets of the iodized oil in the fluid in the sac (Figures 4A and 6). There is one possible source of error in reading this sign. When there is free fluid in the pelvis or in the culdesac and the oil spills through the distal end of the tube and falls into this fluid, this droplet sign may be seen. This happens rarely, but when it does happen the droplets are seen low down in the pelvis near the mid-line and they do not appear to be contained in a sac (Figure 7). The twenty-four-hour film will show this oil disseminated throughout the pelvis, whereas if this emulsion is in the tubal end and contained therein it will still be there on the twenty-four-hour plate, not as an emulsion and not showing the droplet sign, but rather as a bag of oil.

#### CONCLUSIONS

There exists a type of small hydrosalpinx, usually bilateral, the signs of which are difficult to elicit either by history taking or bimanual examination. This condition is not rare in the sterile young married woman and when visualized by hysterosalpingography shows definite pathognomonic signs.

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## INCIDENTAL HEAD SURGERY—ITS EFFECTS ON THE COURSE OF PULMONARY TUBERCULOSIS\*

CLINICAL PRIZE PAPER OF THE SIXTIETH ANNUAL SESSION OF THE CALIFORNIA MEDICAL ASSOCIATION†

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**T**O operate or not to operate—that is the question! The advisability of surgical intervention in the course of pulmonary tuberculosis has long been a subject for controversy.

In the case of emergency surgery, such as acute appendicitis intervening in the course of chronic pulmonary tuberculosis, there is little argument that the patient is entitled to the greatly lessened mortality that follows early operation. In elective conditions, where there is a chronic focus of infection or some localized source of discomfort, the question arises as to whether the benefits accruing from the removal of the offending tissues may not be counterbalanced by the aggravation of the tuberculous process in the lungs.

However, modern sanatorium treatment has so improved the prognosis in this disease that there seems to be an increasing advocacy of a conservative resort to surgery in these patients.

#### COMMENTS ON THE LITERATURE

A perusal of the literature discloses many advocates of head surgery in infection of the tonsils and upper air passages. John C. Boone,<sup>1</sup> after a questionnaire sent out to a large number of chest specialists, concludes: "Opinion is coming more and more to a consideration of tonsillectomy as a therapeutic measure," and adds as a result of his analysis, "There is insufficient evidence of ill effects following removal to offset the positive gains reported." Among the surgical advocates are Pollock, who makes the startling statement: "I am in favor of removing tonsils in every case of tuberculosis and see no reason why it should not be done as it removes one focus of infection." Hyde advises removal of tonsils, if possible, before admission to the sanatorium. Freeman Adams says, "I have always removed infected tonsils in pulmonary tuberculosis, either active or quiescent, and results have justified me sufficiently to continue its practice." However, the majority advocate removal of tonsils in quiescent cases only. Many of those favoring as well as those opposed, qualified their statements by saying, "Each case must be considered individually." This should be the rule, however, in every case of proposed surgery.

Quoting from Brooks<sup>2, 11</sup>: "Imperative surgery must be resorted to and it is surprising how well

\* This paper was submitted under the nom de plume "Ambrose Paré" and was awarded the California Medical Association Clinical Prize of \$150 at the sixtieth annual session of the California Medical Association at San Francisco, April 27-30, 1931.

† Note.—The name of the institution at which this study was carried on was not mentioned in the manuscript. The name has been inserted by the editor.